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TITLEECOLOGICAL BLOCK AND VEGETATION BANK PROTECTIONTECHNICAL FIELD

5           The present invention relates generally to an ecological block and a method for constructing an ecological vegetation bank protection wall and an ecological vegetation retaining wall using such an ecological block, and more particularly to an ecological block which contributes to the restoration and preservation of the ecosystem by provision of block structures with spawning and inhabitable spaces for amphibious  
10 animals and insects and with traveling passages for amphibious animals and insects and a method for constructing an ecological vegetation bank protection wall and an ecological vegetation retaining wall using such an ecological block.

BACKGROUND ART

15           Generally, a bank protection wall of a river is constructed by a concrete retaining wall, a reinforcing stone wall, or by paving a mortar block. Such a bank protection wall destructs inhabitation environment of animals and plants around the river and affects an ecosystem in that a surface soil layer is covered with concrete so that the vegetation of herbaceous plants may be difficult, although it has excellent  
20 capability of preventing corrosion, erosion and loss of a bank. For this reason, there is a need to develop and utilize a method for constructing a naturally ecological vegetation bank protection wall capable of improving water control required for safety of the river as well as water utilization required for restoration and preservation of the ecosystem.

25   DISCLOSURE OF THE INVENTION

The present invention is proposed in order to overcome the aforesaid drawbacks of the prior art.

Therefore, it is an object of the present invention to provide an ecological block which contributes to the restoration and preservation of the ecosystem by provision of block structures with spawning and inhabitable spaces for amphibious animals and insects and with traveling passages for amphibious animals and insects and a method for constructing an ecological vegetation bank protection wall and an ecological vegetation retaining wall using such an ecological block.

The foregoing object is accomplished in a first preferred embodiment by providing an ecological block for constructing a bank protection wall especially on the slope of a riverbank, wherein at least one truncated conical projection adapted for convenient piling up a block structure on another block structure is provided at the upper part of the block body of said ecological block; at least one groove in which said truncated conical projection is engaged is provided at the lower part of the block body of said ecological block; a channel-shaped space in which stones are filled and water grasses are planted during the construction of the bank protection wall is provided at either side of the block body of said ecological block; a through-hole adapted for improving combination and construction of said block structure on the slope of the riverbank is provided approximately at the central part of the block body of said ecological block, said through-hole also functioning as a hiding-place for amphibious animals and insects; and channel-shaped grooves along which the amphibious animals and insects move and rainwater is drained are provided at the front part of the block body of said ecological block, said channel-shaped grooves being arranged about said through-hole in the form of a diamond.

In the preferred embodiment, the block body of said ecological block is

formed such that said bank protection wall is constructed easily at a predetermined angle based on the slope of said riverbank, preferably such that the rear surface and the front surface of the block body of said ecological block are inclined at a predetermined angle to the bottom surface of the block body of said ecological block.

5           The foregoing object is also accomplished in a second preferred embodiment by providing an ecological block for constructing a bank protection wall especially on the slope of a riverbank, wherein at least one truncated conical projection adapted for convenient piling up a block structure on another block structure is provided at the upper part of the block body of said ecological block; at least one groove in which said  
10 truncated conical projection is engaged is provided at the lower part of the block body of said ecological block; a channel-shaped space in which stones are filled and water grasses are planted during the construction of the bank protection wall is provided at either side of the block body of said ecological block; and a channel-shaped groove along which the amphibious animals and insects move and rainwater is drained is  
15 provided vertically at the central part of the block body of said ecological block.

In the preferred embodiment, the block body of said ecological block is formed such that said bank protection wall is constructed easily at a predetermined angle based on the slope of said riverbank, preferably such that the rear surface and the front surface of the block body of said ecological block are inclined at a predetermined  
20 angle to the bottom surface of the block body of said ecological block.

The foregoing object is also accomplished in a third preferred embodiment by providing an ecological block for constructing a retaining wall especially on the cut-area or the cut-slope of a road, wherein at least one truncated conical projection adapted for convenient piling up a block structure on another block structure is provided  
25 at the upper part of the block body of said ecological block; at least one groove in which

said truncated conical projection is engaged is provided at the lower part of the block body of said ecological block; a channel-shaped space in which stones are filled and trees and grasses are planted during the construction of the retaining wall is provided at either side of the block body of said ecological block; and a channel-shaped space adapted for reducing the noise due to the travel of a vehicle during the construction of the retaining wall is provided at the front part of the block body of said ecological block, said channel-shaped groove provided at the front part of the block body of said ecological block being communicated with said channel-shaped space provided at either side of the block body of said ecological block.

10           The foregoing object is also accomplished in a fourth preferred embodiment by providing an ecological block for constructing a retaining wall especially on the cut-area or the cut-slope of a road, wherein at least one truncated conical projection adapted for convenient piling up a block structure on another block structure is provided at the upper part of the block body of said ecological block; at least one groove in which  
15   said truncated conical projection is engaged is provided at the lower part of the block body of said ecological block; a channel-shaped space in which stones are filled and trees and grasses are planted during the construction of the retaining wall is provided at either side of the block body of said ecological block; and V channel-shaped grooves adapted for reducing the noise due to the travel of a vehicle during the construction of  
20   the retaining wall are provided at the front part of the block body of said ecological block approximately in the form of a diamond.

          Furthermore, the foregoing object is accomplished by providing a method for constructing an ecological vegetation bank protection wall especially on the slope of a riverbank using an ecological block according to the present invention, the method  
25   comprising the steps of:

depositing and curing fundamental concrete on the readjusted river bed at a riverbank;

spreading a thread sheet for preventing overflow of soil and sand along the upper part of said fundamental concrete and the slope of said riverbank;

5        providing a first stack of ecological blocks on said fundamental concrete approximately up to a half of the total vertical height of the slope of said riverbank, each of said ecological blocks including a truncated conical projection and a corresponding groove provided at the upper and lower parts of the block body of said ecological block respectively, a channel-shaped space provided at either side of the block body of said  
10       ecological block, and traveling passages for amphibious animals and insects provided at the front part of the block body of said ecological block;

filling relatively large stones in the space between the rear surfaces of said first stacked blocks and the slope of said riverbank where said thread sheet is spread to stabilize the stacking state;

15       providing a second stack of ecological blocks similar to said first stacked blocks in series on said first stacked blocks up to the upper end of the slope of said riverbank;

spreading a thread sheet closely on the rear surfaces of said second stacked blocks and filling pebbles, soil and sand in the space between the rear surfaces of said  
20       thread sheet and the slope of said riverbank to stabilize the stacking state; and

filling stones, soil and sand and planting water grasses in a closed space formed between the neighboring blocks by the channel-shaped spaces provided at the sides of said ecological blocks of said riverbank formed by said first and second stack.

Also, the foregoing object is accomplished by providing a method for  
25       constructing an ecological vegetation retaining wall especially on the cut-area or the

cut-slope of a road using an ecological block according to the present invention, the method comprising the steps of:

depositing and curing fundamental concrete on the edge of a road;

stacking ecological blocks on said fundamental concrete up to a predetermined  
5 height, each of said ecological blocks including a truncated conical projection and a corresponding groove provided at the upper and lower parts of the block body of said ecological block respectively, and channel-shaped grooves provided at either side of the block body of said ecological block and at the front part of the block body of said ecological block respectively for planting trees and grasses and reducing noise;

10 spreading a thread sheet for preventing overflow of soil and sand along the rear surfaces of said stacked ecological blocks;

filling soil and stones in the space between the rear surfaces of said stacked blocks where said thread sheet is spread and the cut-slope of the road to stabilize the stacking state; and

15 filling stones, soil and sand and planting trees and grasses in a closed space formed between the neighboring blocks by the channel-shaped grooves provided at the sides of said ecological blocks of said retaining wall formed by said stack.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

20 Other objects and aspects of the present invention will become apparent from the following description of embodiments with reference to the accompanying drawings in which:

Fig. 1 is a perspective view showing the structure of an ecological block according to a first preferred embodiment of the present invention;

25 Fig. 2 is a sectional side view of the ecological block of Fig. 1;

Fig. 3 is a perspective view showing the structure of an ecological block according to a second preferred embodiment of the present invention;

Fig. 4 is a sectional side view of the ecological block of Fig. 3;

Fig. 5 is a perspective view showing the structure of an ecological block according to a third preferred embodiment of the present invention;

Fig. 6 is a sectional side view of the ecological block of Fig. 5;

Fig. 7 is a perspective view showing the structure of an ecological block according to a fourth preferred embodiment of the present invention;

Fig. 8 is a sectional side view of the ecological block of Fig. 7;

Fig. 9 is a side view showing a state that an ecological vegetation bank protection wall is constructed using the ecological block of Fig. 1;

Fig. 10 is a front view showing a state that the bank protection wall of Fig. 9 is constructed;

Fig. 11 is a side view showing a state that an ecological vegetation retaining wall is constructed using the ecological block of Fig. 5; and

Fig. 12 is a front view showing a state that the retaining wall of Fig. 11 is constructed.

### **BEST MODE FOR CARRYING OUT THE INVENTION**

The preferred embodiments of the present invention will now be described in detail with reference to the accompanying drawings.

Fig. 1 and Fig. 2 show an ecological block according to a first preferred embodiment of the present invention; Fig. 1 is a perspective view of the ecological block and Fig. 2 is a sectional side view of the ecological block.

Referring to Fig. 1 and Fig. 2, an ecological block 100 according to a first

preferred embodiment of the present invention is used especially for constructing a bank protection wall on the slope of a riverbank. At least one (for example, two) truncated conical projection 102 adapted for convenient piling up a block structure on another block structure during the construction of the bank protection wall is provided at the upper part 101 of the block body of the ecological block. At least one groove 104 in which the truncated conical projection 102 is engaged is provided at the lower part 103 of the block body of the ecological block. A channel-shaped space 105 in which stones are filled and water grasses are planted during the construction of the bank protection wall is provided at either side of the block body of the ecological block, and a through-hole 106 adapted for improving combination and construction of the block structure on the slope of the riverbank is provided approximately at the central part of the block body of the ecological block. The through-hole 106 functions as a hiding-place for amphibious animals and insects. Also, channel-shaped grooves 107 - 110 along which the amphibious animals and insects move and rainwater is drained are provided at the front part of the block body of the ecological block. The channel-shaped grooves 107 - 110 are arranged about the through-hole 106 in the form of a diamond.

In the preferred embodiment, the block body of the ecological block is formed such that the rear surface and the front surface of the block body of the ecological block are inclined at the slope rate of 1:0.3 to the bottom surface of the block body of the ecological block in order to construct the bank protection wall at the slope rate of 1:0.5 based on the slope of the riverbank, as shown in Fig. 2. In other words, if the block body of the ecological block has the slope rate of 1:0.3, it is possible to construct easily the bank protection wall at the slope rate of 1:0.5 when the fundamental concrete is deposited such that the stack surface of the concrete is inclined at the slope rate of 1:0.2.

Fig. 3 and Fig. 4 show an ecological block according to a second preferred



embodiment of the present invention; Fig. 3 is a perspective view of the ecological block and Fig. 4 is a sectional side view of the ecological block.

Referring to Fig. 3 and Fig. 4, an ecological block 300 according to a second preferred embodiment of the present invention is used especially for constructing a bank protection wall on the slope of a riverbank, as in the ecological block according to the first preferred embodiment of the present invention. The ecological block 300 according to the second preferred embodiment of the present invention is extremely similar to the ecological block 100 according to the first preferred embodiment of the present invention in terms of the entire structure. Accordingly, elements of the ecological block according to the second preferred embodiment of the present invention similar to those of the first preferred embodiment of the present invention has been accorded to the identical reference numerals with the descriptions thereof omitted, while different elements will be described below.

The ecological block 300 according to the second preferred embodiment of the present invention is different from the ecological block 100 according to the first preferred embodiment of the present invention in that a channel-shaped groove 307 along which the amphibious animals and insects move and rainwater is drained is provided vertically at the central part of the block body of the ecological block. In this second preferred embodiment, capacity for draining rainwater is particularly excellent because the channel-shaped groove 307 is provided vertically. Also, in the preferred embodiment, as in the first preferred embodiment, the block body of the ecological block is formed such that the rear surface and the front surface of the block body of the ecological block are inclined at the slope rate of 1:0.3 to the bottom surface of the block body of the ecological block in order to construct the bank protection wall at the slope rate of 1:0.5 based on the slope of the riverbank, as shown in Fig. 4.

Fig. 5 and Fig. 6 show an ecological block according to a third preferred embodiment of the present invention; Fig. 5 is a perspective view of the ecological block and Fig. 6 is a sectional side view of the ecological block.

Referring to Fig. 5 and Fig. 6, an ecological block 500 according to a third preferred embodiment of the present invention is used especially for constructing a retaining wall on the cut-area or the cut-slope of a road. The ecological block 500 according to the third preferred embodiment of the present invention is extremely similar to the ecological block 100 according to the first preferred embodiment and the ecological block 300 according to the first preferred embodiment of the present invention in terms of the entire structure. Accordingly, elements of the ecological block according to the third preferred embodiment of the present invention similar to those of the first preferred embodiment of the present invention has been accorded to the identical reference numerals with the descriptions thereof omitted, while different elements will be described below.

The ecological block 500 according to the third preferred embodiment of the present invention is different from the ecological block 100 according to the first preferred embodiment of the present invention in that a channel-shaped space 105 in which stones are filled and trees and grasses are planted during the construction of the retaining wall is provided at either side of the block body of the ecological block, a channel-shaped space 507 adapted for reducing the noise due to the travel of a vehicle during the construction of the retaining wall is provided at the front part of the block body of the ecological block, and the channel-shaped groove provided at the front part of the block body of the ecological block is communicated with the channel-shaped space provided at either side of the block body of the ecological block, and in that the rear surface of the block body of the ecological block is perpendicular to the bottom

surface of the block body of the ecological block.

Fig. 7 and Fig. 8 show an ecological block according to a fourth preferred embodiment of the present invention; Fig. 7 is a perspective view of the ecological block and Fig. 8 is a sectional side view of the ecological block.

5 Referring to Fig. 7 and Fig. 8, an ecological block 700 according to a fourth preferred embodiment of the present invention is used especially for constructing a retaining wall on the cut-area or the cut-slope of a road, as in the ecological block 500 according to a third preferred embodiment of the present invention. The ecological block 700 according to the fourth preferred embodiment of the present invention is also  
10 extremely similar to the ecological blocks according to the first, second and third preferred embodiments in terms of the entire structure. Accordingly, elements of the ecological block according to the fourth preferred embodiment of the present invention similar to those of the first preferred embodiment of the present invention has been accorded to the identical reference numerals with the descriptions thereof omitted, while  
15 different elements will be described below.

The ecological block 700 according to the fourth preferred embodiment of the present invention is different from the ecological block 500 according to the third preferred embodiment of the present invention in that V channel-shaped grooves 707 - 710 adapted for reducing the noise due to the travel of a vehicle during the construction  
20 of the retaining wall are provided at the front part of the block body of the ecological block approximately in the form of a diamond. Furthermore, the ecological block 700 according to the fourth preferred embodiment of the present invention is different from the ecological block 100 according to the first preferred embodiment of the present invention in that the rear surface of the block body of the ecological block is  
25 perpendicular to the bottom surface of the block body of the ecological block.

Fig. 9 to Fig. 12 show states that the ecological vegetation bank protection wall or the ecological vegetation retaining wall is constructed according to a method for constructing the ecological vegetation bank protection wall or the ecological vegetation retaining wall using the ecological block according to the present invention, respectively; Fig. 9 and Fig. 10 illustrate states that an ecological vegetation bank protection wall is constructed using the ecological block according to the first preferred embodiment, and Fig. 11 and Fig. 12 illustrate states that an ecological vegetation retaining wall is constructed using the ecological block according to the third preferred embodiment.

Referring to Fig. 9 and Fig. 10, a method for constructing an ecological vegetation bank protection wall using the ecological block according to the present invention will be described. First, fundamental concrete 120 is deposited and cured on the readjusted river bed at a riverbank. At this time, the upper part of the concrete 120 on which the ecological blocks are stacked is formed such that it is inclined at the slope rate of 1:0.2 when the fundamental concrete 120 is deposited. It ensures that the inclination of the bank protection wall is 1:0.5 after the construction is complete by stacking the ecological blocks because the front inclination of the front part of the ecological block 100 is 1:0.3. After the fundamental concrete 120 has been cured, a thread sheet (construction fiber) 121 for preventing overflow of soil and sand is spread along the upper part of the fundamental concrete 120 and the slope of the riverbank. Next, on the fundamental concrete 120 approximately up to a half of the total vertical height of the slope of the riverbank are stacked firstly the ecological blocks 100 (Fig. 1), each of which includes a truncated conical projection 102 and a corresponding groove 104 provided at the upper and lower parts of the block body of the ecological block respectively, a channel-shaped space 105 provided at either side of the block body of

the ecological block, and channel-shaped grooves 110 along which the amphibious animals and insects move provided at the front part of the block body of the ecological block. Next, relatively large stones (boulder) 122 is filled in the space between the rear surfaces of the first stacked blocks 100 and the slope of the riverbank where the thread  
5 sheet 121 is spread to stabilize the stacking state. After that, ecological blocks similar to the first stacked blocks 100 are stacked secondly in series on the first stacked blocks 100 up to the upper end of the slope of the riverbank. And then, a thread sheet 121 is spread closely on the rear surfaces of the second stacked blocks 100 and filling pebbles, soil and sand 123 in the space between the rear surfaces of the thread sheet 121 and the  
10 slope of the riverbank to stabilize the stacking state.

After the first and second stack is complete as mentioned above, stones, soil and sand are filled and water grasses 125 are planted in a closed space 124 formed between the neighboring blocks by the channel-shaped spaces provided at the sides of the ecological blocks 100 of the riverbank formed by the first and second stack. At this  
15 time, only stones are filled in a closed space 124' formed by the ecological blocks 100 submerged under the surface of the water in the river so that spawning and inhabitable spaces for amphibious animals are ensured. Of course, submerged plants, such as *Hydrilla verticillata*, *Ceratophyllum demersum*, *Potamogeton crispus*, *Vallisneria asiatica*, etc., may be planted among the stones. In this way, the construction of the  
20 ecological vegetation bank protection wall using the ecological block is complete.

If the bank protection wall is constructed as mentioned above, the water grasses 125 planted among the blocks 100 constitute a forest, resulting in that pro-environmental bank protection wall harmonized with the surrounding scenic beauty is constructed and the excellent spawning and inhabitable spaces for amphibious  
25 animals and insects are provided.

Fig. 11 and Fig. 12 illustrate states that an ecological vegetation retaining wall is constructed according to a method for constructing the vegetation retaining wall using the ecological block according to the present invention, respectively. First, fundamental concrete 130 is deposited and cured on the edge of a road. At this time, it is possible to  
5 use a side ditch instead of the fundamental concrete if the side ditch is provided at the edge of the road when the road is paved.

After the fundamental concrete 130 has been deposited and cured, ecological blocks 500 (Fig. 5), each of which includes a truncated conical projection 102 and a corresponding groove 104 provided at the upper and lower parts of the block body of  
10 the ecological block respectively, and channel-shaped grooves 105 and 507 provided at either side of the block body of the ecological block and at the front part of the block body of the ecological block respectively for planting trees and grasses and reducing noise, on the fundamental concrete 130 up to a predetermined height. Next, a thread  
sheet 131 for preventing overflow of soil and sand is spread along the rear surfaces of  
15 the stacked ecological blocks 500. After that, soil and stones 132 are filled in the space between the rear surfaces of the stacked blocks 500 where the thread sheet 131 is spread and the cut-slope of the road to stabilize the stacking state. And then, stones, soil and sand are filled and trees and grasses 135, such as mountain willows, wild flowers, etc., are planted in a closed space 134 formed between the neighboring blocks by the  
20 channel-shaped grooves provided at the sides of the ecological blocks 500 of the retaining wall formed by the stack.

If the retaining wall is constructed as mentioned above, excellent landscape architecture can be obtained because desolation and monotony of the prior concrete retaining wall is avoided, and the noise can be reduced sharply because most of the  
25 noise due to the travel of a vehicle is absorbed by the jagged ecological blocks 500 and

the trees and grasses planted between the blocks.

### **INDUSTRIAL APPLICABILITY**

With the ecological block according to the present invention and the method  
5 for constructing the ecological vegetation bank protection wall and the ecological  
vegetation retaining wall using the ecological block, it is possible to construct  
pro-environmental bank protection wall harmonized with the surrounding scenic beauty  
since the traveling passages for amphibious animals and insects, the spaces in which the  
water grasses are planted, and channel-shaped grooves are provided at the ecological  
10 block, and water grasses are planted in a closed space formed between the ecological  
blocks by assembly of the ecological blocks, and it is possible to restore and preserve  
the ecological environment since excellent spawning and inhabitable spaces for  
amphibious animals and insects are provided. Furthermore, it is possible to obtain  
excellent landscape architecture since desolation and monotony of the prior concrete  
15 retaining wall is avoided, and it is possible to reduce the noise sharply since most of the  
noise due to the travel of a vehicle is absorbed.